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Chapter 11. Utilities Management

11.1 Introduction

11.1.1 This chapter provides guidance for utilities planning and management and describes the concepts and philosophy for the O&M of central and satellite utility plants, such as central heating plants, central chilled water (chiller) plants, air compressor plants, and water and wastewater treatment plants. These central utility plants are normally operated and maintained by a Center's facilities maintenance organization.

11.1.2 Current policies affecting the planning and management of utilities are: NPR 8570.1, Energy Efficiency and Water Conservation; NPR 8553.1, NASA Environmental Management System (EMS); Energy Policy Act (EPAct) 2005; and Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management. Comprehensive planning and management of utilities are essential for securing adequate and cost-effective supplies of current and expected needs of electricity, natural gas, steam, water, and wastewater treatment for NASA. The intent is to secure the most reliable utility services at the lowest cost consistent with NASA's mission, environmental standards, and waste reduction. The utilities are required to support various energy-consuming systems at NASA facilities. Some of the primary energy-consuming systems commonly found at NASA facilities include the following:

a. Heating and power plants.

b. Steam distribution systems.

c. Hot water and chilled water distribution systems.

d. Electrical distribution systems.

e. Compressed-air distribution systems.

f. Wind tunnels.

11.2 Planning and Management

11.2.1 While existing utility requirements are satisfied, future growth, as well as emergency situations, should be anticipated and properly planned for. Factors to consider are the future needs of the utilities and system capabilities, potential threats to existing services, alternative solutions to ensure adequate future supply, and finding and developing new sources of the energy products. Where necessary, utility systems upgrades should be implemented where new sources have not been identified. Utility planning and management instituted to promote system efficiency should also include emergency preparedness.

11.2.2 At the Center level, utilities management has the following major functions:

a. System development. System development is directed toward the design or planned improvement of generation, distribution, and collection facilities to achieve efficient and economical system operation. Inherent in system development is the evaluation of alternatives, such as the types of energy to be used, centralized versus decentralized systems, and the means to acquire utility services.

b. Operations and distribution. Operations and distribution are directed toward maximizing the efficiency of production, distribution, and collection equipment using minimum labor and materials.

c. Inspection and maintenance. Inspection and maintenance are directed toward minimizing cost and system downtime while ensuring safety.

d. Usage control. Usage control is directed toward minimizing waste.

11.2.2.1 In addition to ensuring adequate, reliable, and cost-effective utility services, proper utilities planning and management requires attention to such external factors as privatization initiatives, electric utility deregulation, utility purchasing options, and the future of demand-side management.

11.2.2.2 Utilities and central plants should normally be interfaced and controlled with modern building automation systems (BAS) or energy management and control systems (EMCS) for control technology. This will allow for modern energy efficient control, visibility, monitoring, trending, and metering. Interface of these larger systems with modern controls technology is necessary in order to optimize both energy and maintenance efficiency through use of trending, utility-use tracking, load-shedding planning, and establishing baselines for future equipment modeling and cost analyses. Proper interface of these technologies will greatly enhance the possibility of cost-saving measures such as peak shaving and possible energy-saving performance contracts.

11.2.3 Privatization

11.2.3.1 The privatization of utility functions is the transfer of in-house operations to private entities. Privatization can be executed by outsourcing or by asset sale. Outsourcing is contracting services through a competitive bidding process, while maintaining financial, management, and policy control over the services. Asset sale is the transfer of ownership to the private sector, where the Government has no role in the oversight of the sold assets (see Appendix C, resource 22). The goal of privatization is to achieve savings resulting from the introduction of new technologies, increased worker productivity, and improved operating efficiencies. The following factors will greatly reduce the risk in privatization:

a. Clear need and demand for service.

b. Visible total cost of in-house service.

c. Capability to provide oversight of and monitor the effectiveness of contractors.

d. Local control of decision to privatize.

e. Clearly defined goods and services.

f. Ability to define acceptable quality in measurable terms.

g. Flexibility to balance cost and quality.

h. Competitive markets.

11.2.3.2. The focus of many privatization efforts is to achieve a high level of reliability while optimizing in-house resources. In-house expertise must be maintained in order to facilitate contractor relations. Careful communication and planning with personnel are imperative when it comes to alleviating the perceived threat of contracted services. The best available in-house skills are needed to establish contractor accountability and review performance evaluations. The benefit of privatization is that the burden of daily operations is transferred to the contractor who has greater flexibility to hire the necessary expertise and implement technology on an as-needed basis, thereby optimizing resources.

11.2.4 Fuel Source Planning

11.2.4.1 Dual-fuel capability is any technology that provides the ability to switch from one fuel source to another for generating energy, thus reducing dependence on any one source of supply. A facility with dual capability can switch relatively easily and quickly to a second fuel if the first fuel is either unavailable or more expensive per delivered BTUs than the second fuel. Field installations should pursue alternative energy sources and identifying candidate projects. For many NASA Centers, the most feasible of these is natural gas conversion, but other possibilities, as diverse as refuse-fired steam plants or geothermal heat exist. The benefits of such initiatives include reduced susceptibility to petroleum market forces, less pollutant emissions, and possible reduction in facility maintenance requirements. Expansion of natural gas usage could allow replacement of high-energy-consuming electrical equipment and appliances with gas-fired units.

11.2.4.2 The main practical application of dual-fuel capability is to support the purchase of natural gas on the "spot"

market--an alternative contracting mechanism for purchasing natural gas. The spot market refers to the purchase of gas from the producer rather than the local gas utility. The end user can make spot purchases either directly from the producer or indirectly via a gas marketer. Spot market transactions are usually short-term, "interruptible" purchases. Interruptible deliveries can be interrupted by any one of a number of contingencies: unusually cold weather, producer shutdowns, and/or a temporary lack of pipeline capacity.

11.2.4.3 Short-term interruptible contracts make supplies less certain. In addition, while spot market gas is normally cheaper than gas purchased under long-term contracts, prices can increase more quickly. Both possibilities make dual-fuel capability almost essential when purchasing spot gas. When natural gas is unavailable or undergoes a rapid escalation in price, a facility can switch dual-fuel boilers relatively quickly to burn fuel oil instead. Such a facility can then switch back to natural gas when it becomes available and affordable. Some local distributors will reduce the price of their natural gas if the field installation agrees to switch to an alternative fuel during a time when capacity has been curtailed. Such an arrangement can result in savings for both the local distribution company and the field installation.

11.2.4.4 The spot market for natural gas expanded dramatically when the Natural Gas Policy Act (NGPA) of 1978 deregulated the market. All field installations with the potential for participation in wholesale natural gas contracting may participate in the central procurement program offered by the Defense Logistics Agency (DLA). Field installations interested in taking advantage of the potential cost savings available in the spot market for natural gas should contact the Defense Energy Support Center (DESC) for information about their Competitive Direct Supply Natural Gas Program. The GSA National Center for Utilities Management also provides contracting support to Federal agencies.

11.2.5 Electric Utility Deregulation National Status

11.2.5.1 Electricity competition in the United States is continuing to reshape the electric utility business. Historically, electric utilities have been vertically integrated utilities regulated by state Public Service Commissions (PSC), which are also known as Public Utility Commissions (PUC). The commissions have allowed the utilities to operate as natural monopolies within defined geographic boundaries. The typical electric customer purchased power in a packaged deal--electricity production, transmission and distribution, metering, billing, and special services. The transmission and distribution services will continue under the regulatory guidelines set forth by the PUC.

11.2.5.2 The functional operations of a utility will not change. However, the power generation, and energy services will be contracted in a nonregulated environment that fosters competition. The Federal Government has shared the responsibility of implementation to the states since each state has different operational concerns in electric service. In some states, the authority to implement retail competition, be it the state legislature or the PUC, has not been clearly defined.

11.2.6 NASA Host State Electric Utility Deregulation Update. Various aspects of electric utility economics functions are being scrutinized by individual states as the Nation transitions into a competitive electric power market. States that have been the most aggressive in passing laws and implementing open-access transmission on the retail level are those states where the average cost of electricity is 20- to 60-percent above the national average. Contact information regarding the electric utility deregulation status for each NASA host state can be found in Appendix C.

11.2.7 Utility Purchasing Options. Many different utility purchasing options exist. However, the purchase process has become more complex due to utility deregulation. Being aware of energy utilization enables our understanding of rate applicability and appropriateness.

11.2.7.1 Rate Structures

a. Utility providers design rate structures that capture the cost of production and delivery of the commodity. The components of the rate structure vary depending on the volume, time of use, and customer size. The price mechanisms used to set rate structures include the cost for capital investment, service delivery, operating expenses, pollution control, and environmental and social externalities.

b. Rate structures imposed usually reflect consumption patterns and users. Most electric utilities offer one of the four following models as follows:

1. General rate structures are geared toward users with low-consumption volume that is variable and difficult to forecast.

2. Stable-volume rate structures are for users with predictable loads and minimum time-of-use or seasonal variation.

3. Interruptible rates are for users with alternative power supplies. At the request of the utility supplier, service may be interrupted or curtailed for a limited period during the supplier's peak. The user can receive credit for helping to relieve the supplier's burden of peak supply.

4. Modular rates are for users whose consumption is difficult to forecast. Typically, consumption is sufficiently high to qualify for these rates.

c. Within the rate structures mentioned, price components may vary depending on mechanisms imposed or negotiated. Bill components may include the basic customer service charge, energy-use charge, energy-demand charge, taxes, and environmental-compliance recovery. High-consumption users can take advantage of other pricing mechanisms that may yield alternative cost-saving opportunities, such as real-time pricing (RTP), voltage-service discounts, and riders.

1. RTP is the hourly energy pricing usually purchased a day in advance. Typically, rates are higher during peak use periods. With RTP, facility managers can plan to implement energy-use strategies to reduce consumption during high-price periods. Depending on the energy supplier, RTP can be applied to usage that exceeds baseload definitions. The baseline capacity is purchased at standard rates. The RTP rates are supplied to the customer a day in advance. If the next day's usage exceeds the baseline, then the RTP rates are charged. For usage below the baseline, the customer receives a credit at the RTP rates per unit of the commodity.

2. Electric utilities offer discounts to customers who take advantage of high-voltage service. The utility feeds the high-voltage service directly to customer-owned distribution equipment such as transformers, switchgear, and safety equipment.

3. Riders are associated with the use of new technology and participation in pilot programs or experimental services. Riders may be special charges or discounts applied to existing rate schedules. The rider type and amount will vary with the utility provider.

11.2.7.2 Load Aggregation

a. Load aggregation is the grouping of facilities with similar energy requirements and energy-use patterns for the purpose of creating a conglomerate to increase purchasing power, thereby, reducing the energy costs.

b. Load aggregation includes central collection of energy use data from geographically dispersed sites. With the proper instrumentation, energy load data can be gathered to explore the best available rate options for a defined group of uses at multiple service accounts or facilities. If the user profiles are similar, the composite information can result in an attractive energy use profile and load factor. The attractiveness comes in the consistency and predictability of energy use patterns, which reduces the power producer's risk in generating electricity, thereby reducing the price. With load aggregation, measuring when and how energy supplies are used enables the aggregators to negotiate the best price for energy contracts.

c. Differences in climates, occupants, and building construction are additional issues of concern when considering the potential for load aggregation.

d. Load aggregation enables the end-users to develop competitive leverage against host utilities.

11.2.7.3 Unbundled Services. Transmission and distribution services will still be regulated to ensure accessibility, safety, and reliability. Transmission entities will be regulated by the Federal Energy Regulatory Commission and will provide service via the power exchange or independent system operators. The distribution entity will remain as at present--wires will still be used to supply electricity in compliance with state regulations. Generation companies, the owners of power plants, will sell power to power pools and distribution companies. They will also have opportunities to contract with the power exchange, independent system operators, and retail customers. Competitive energy services, dubbed as retail services, will introduce a broad range of energy-efficiency programs and services in a deregulated environment. The energy retailer will have opportunities to market customers, procure power for customers, and provide account management services.

11.2.7.4 Competitive Bidding. Competitive bidding is the process of comparing bids solicited from individual contractors. All bids shall be evaluated under the same guidelines. The contract award usually goes to the bidder offering the best-value solution.

11.2.7.5 Existing Utility Service Providers. Local utility providers will still play an important role in future electricity procurement. They will still provide transmission and distribution services for NASA Centers. The purchasing options are as follows:

a. Continue all services with the local utility company.

b. Select a hybrid arrangement with the utility supplying base loads and an alternative provider supplying critical or excessive loads.

c. Select alternative providers for generation and energy services.

11.2.7.6 Federal Support for Power Procurement

a. Two Government entities, the DESC and the GSA, offer varying degrees of electricity procurement support. The DESC's mission is to provide the DoD and other Government agencies with comprehensive energy support in the most effective and economical manner possible.

b. GSA's Public Utilities Division also provides electricity procurement services for Federal agencies. GSA has

organized a Center of Expertise to facilitate activities relative to energy conservation and management, deregulation and utilities, and other public utilities interests. Each GSA region will assist facilities with price negotiations and contracting services. Appendix C contains the list of regions along with the geographic areas of coverage, regional energy coordinators, and model areawide contract.

11.2.7.7 Alternative Utility Service Providers

a. The competitive power market will involve a variety of agents to coordinate electricity transactions: utility companies, power producers, independent system operators, and power marketers.

b. Utility companies will be the basic electric service providers with an obligation to serve incumbents and those who live within the service area. Utilities will be regulated, with the mandate to provide universal service, ensure social and environmental responsibility, and construct and maintain all distribution lines. The only changes in the core business of the utility and transmission service will be the price and terms of electric service, since the utility will be the reseller of electricity from the market.

c. Nonutility power producers will engage in a competitive bidding process to provide electricity. The end user will be responsible for arranging delivery services. The diversity of power producers increases the opportunity to coordinate generation operations and maintenance. However, strict scheduling will be needed to ensure the delivery of safe and reliable power.

d. An independent system operator will be commissioned to maintain network efficiency and reliability of the generation and transmission system. The independent system operator will also be charged with monitoring fair and open access to the transmission system. Controlled service areas will be or will have been established in order for the independent system operator to maintain a balance of supply resources with user demands and to dispatch generators accordingly.

e. Power marketers typically serve as intermediaries between buyers and sellers, reduce prices, and offer value-added services. As commodity brokers, power marketers compete with each other to find and deliver the most economical and reliable power available to the customers.

11.2.7.8 Utility Energy Efficiency Service Contracts. Alternative contract mechanisms for implementing energy-efficiency improvements are specified in NPR 8570.1, Energy Efficiency and Water Conservation.

11.2.8 Data Management

11.2.8.1 The modern building automation industry has developed utility management systems that integrate the ability to collect billing-grade metering, process, bill, trend, evaluate/manage, and control utilities. This can often be accomplished with minimal investment, through use of the existing building automation infrastructure.

11.2.8.2 Metering of all utilities, including process-related services, provides sufficient data to review billing transactions, usage patterns and levels, and system efficiencies. Data management packages the metered information in a manner that provides visual identification of problems and opportunities. Performance problems can be quickly identified followed by immediate corrective action. Opportunities for energy-efficiency projects can be evaluated and justified with data. This knowledge base helps energy managers and facility management personnel with proper resource allocation.

11.2.8.3 Some utilities are currently offering group billing to consolidate accounts for those customers with multiple facility metering. Electronic files are available upon the customer's request. These services reduce the burden on energy accounting and reporting functions. Data management provides the following services:

a. Streamlined billing process that reduces accounts payable encumbrance and simplifies data entry.

b. Utility bill validation that identifies incorrect billing factors and provides usage versus weather statistics.

c. Energy analysis that identifies building or system inefficiencies, tenant-usage patterns, and billed versus actual demand.

d. Rate schedule appropriateness that verifies account ownership and ensures best available rates for service, late fees, taxes, and surcharges.

e. Retrofit evaluation that assesses energy retrofit cost avoidance and determines effectiveness of energy management programs.

f. Budget preparation that provides data for preparing cost and usage trending reports.

11.3 Central Utility Plant Operations and Maintenance

11.3.1 Objectives. The objective of the O&M of central utility plants is to provide reliable, economical, and efficient central plant and utility services to support Center needs and missions, while complying with all regulatory requirements.

11.3.2 Plant Operations and Maintenance Considerations. The concept for the O&M of a central utility plant is that operators are assigned full time to operate the plant, but they perform maintenance between various operating tasks. Operator maintenance, as it is often referred to, involves a significant integration of facilities and equipment inspection and maintenance with routine watch-standing operations.

11.3.2.1 Staffing. Central utility plant operations and maintenance normally require a nearly constant level of effort, varying only with seasonal changes. Operators as a minimum must meet license, permit, and certification requirements per paragraph 3.6.2.3, Licenses, Permits, and Certifications. In addition to these requirements, plant operators must be thoroughly familiar with the assigned plant and its operating, maintenance, and safety requirements. Staffing levels can be greatly reduced (although not eliminated), while greatly enhancing reliability, through the application of BAS or EMCS technology. Critical failure and out-of-tolerance conditions shall be established as alarmable points for the EMCS operator work station. While application of this type technology has been an industry practice in the HVAC industry, the modern trend and capability exists to expand this approach to cover electrical system, potable water treatment and distribution, waste water handling and treatment, chemical treatment, and other operations.

11.3.2.2 Maintenance Actions. Condition-monitoring (PT&I) and PM actions are frequently a part of the operating procedures for central utility plants and are performed by the operators as part of their routine watch-standing duties. Additionally, plant operators may be directly involved with the repairs, ROI, and PGM on those portions of the plant they operate. Maintenance action development should use the techniques discussed in Chapter 7, Reliability Centered Maintenance.

11.3.2.3 Standards. Central utility plants are usually process oriented, production, and service focus for standards that emphasize equipment and system availability. These standards should identify conditions that require nonoperator assistance, as well as conditions addressed by the operators. The methods for setting standards discussed in paragraph 10.3, Facilities Condition Standards, are applicable and should be used.

11.3.2.4 Operator Maintenance (Inspections). Operator maintenance is the examination, lubrication, minor repair (usually no larger in scope than TC), and adjustment of equipment and systems in the assigned plant. This maintenance and the inspections are directed toward minimizing system downtime and minimum cost. Operators should provide condition assessments for documentation in the CMMS as a part of the continuous inspection program.

11.3.2.5 Standard Operating Procedures. Standard operating procedures shall be developed to cover routine operations, startup and shutdown, operator maintenance, PM, PT&I, and emergency actions such as load-shedding plans, emergency customer notification, and local utility company coordination. Contingency plans shall be developed and kept current.

11.3.2.6 Inspection and Certification. All central utility plant boilers and unfired pressure vessels shall be inspected and certified in accordance with NPD 8710.5, NASA Safety Policy for Pressure Vessels and Pressurized Systems.

11.3.3 Heating Plant Operations. The operation of a central heating plant includes startup and shutdown of heating equipment and operator maintenance and inspection. Operations include the efficient and economical production of steam or high-temperature hot water to ensure its availability to the Center at the lowest-possible cost. This work also includes record keeping of operations and conditions and analysis of records to correct nonoptimal practices. It includes water treatment; monitoring warranties; testing operations and capabilities of the central heating plant; periodic operation and inspection of idle equipment; and cleaning, preservation, lubrication, and adjustment of plant equipment. Also included are boiler emissions testing and record keeping for environmental regulations and permit compliances. Heating plant operations require control of the following functions:

11.3.3.1 Equipment Scheduling. Equipment scheduling requires matching heat generation with heat load requirements. This requires knowledge of demand curves, unit-cost curves (with selection of single-boiler operation or multiboiler operation), banking and startup costs, loading factors, and monitoring of both equipment selection and scheduling.

11.3.3.2 Equipment Operation. Equipment should be operated to achieve operating efficiency at operating loads. To accomplish this, boiler performance should be analyzed based on actual operational data taken from logbooks and used to identify changes required to achieve optimum efficiency in steam/hot water production. Hourly log entries shall include weather data; stack temperature; feed water data; steam/hot water quantities, pressures, and temperatures; and carbon dioxide and oxygen readings. The optimum thermal efficiency curve for each unit should be obtained from the boiler manufacturer and used in operating the boilers. Many of these logged data points, which have historically been manual, can be obtained with automation technology. Likewise, energy efficiency and reliability should be enhanced through use of EMCS automated control strategies that optimize the selection and quantities of equipment that operate for a given plant load.

11.3.3.3 Water Testing and Treatment. At each daily shift turnover that a plant is in operation, the operators should collect feedwater, boiler water, and condensate samples from each operating boiler for testing. Tests results should be maintained within Center-established limits for phosphate, sulfite, pH range, hardness, causticity (alkalinity as

OH), and total dissolved solids. Test results should be recorded with plant reports and logs.

11.3.3.4 Plant Reports and Logs. The operators shall maintain operating logs on all operating equipment that note operator checks and adjustments and a record file noting normal or abnormal operating conditions, deficiencies or malfunctions, and corrective action taken. All recording charts and logs should be filed chronologically and kept in accordance with Center policy.

11.3.4 Central Chilled Water (Chiller) and Air Compressor Plants. Plant operations shall be conducted in accordance with applicable manufacturer's recommendations (such as manuals, specifications, brochures, literature, directives, and pamphlets), and Center-established policies including, but not limited to, safety, energy conservation, and specific mission requirements. A part of operations should be the performance of any needed minor adjustments and repairs (see paragraph 11.3.2, Plant Operations and Maintenance Considerations).

11.3.4.1 Cooling Tower Systems. The O&M of cooling tower systems should include the performance of any needed minor adjustments and repairs to structures and components and monitoring and treating circulating water to prevent accumulation by precipitation of scale, corrosion, biological growths, and other foreign materials. Also included should be flushing and cleaning the cooling tower pans (sumps) and disposal of sludge from the pans. Sludge disposal shall be in accordance with environmental rules and regulations since sludge is considered hazardous waste.

11.3.4.2 Chemical Treatment of Closed-Loop Distribution Systems. Centers shall establish and maintain a chemical treatment program for the central cooling plant distribution systems. Inspection checks and subsequent adjustments should be made to chemicals at least every 90 days to maintain pH limits of 7.0-to-10.0, and nitrite levels of 500-to-1,000 ppm as NO2. Detailed records of the results of all inspection checks and chemical treatments should be maintained.

11.3.4.3 Plant Reports and Logs. Equipment deficiencies beyond the scope of operator maintenance shall be noted on operational log sheets or recorded in the CMMS. Log sheets shall be filled out as part of each operational check. Cooling tower and closed-loop distribution system data shall be recorded in the CMMS for future contracting purposes. (See Chapter 12, Contract Support.)

11.3.4.4 Modern trends in the operation and control of chillers have resulted in great improvements to the efficiency and reliability of chilled water plants. Strategies for equipment staging, variable flow to reduce low-temperature differential, and reduced condenser water temperature capabilities of some modern equipments allow for reduced maintenance problems and improved water-temperature control and quality, while greatly improving energy efficiency. Even with these trends, many plants are still operated with constant high condenser water temperatures and manual-operator selection of equipment. Since these plants are a primary consumer of energy and maintenance, there is a potential of huge payback through optimizing these operations. Also, staffing levels can be greatly reduced (although not eliminated), while greatly enhancing reliability, through the proper application of BAS or EMCS technology. Critical failure and out-of-tolerance conditions shall be established as alarmable points for the EMCS operator work station.

11.3.5 Water Treatment Plants. These plants include water pumping and treatment equipment and storage tanks. The plants should be operated and maintained as recommended by the equipment manufacturers and in accordance with Center, local, state, and Federal laws, rules, and regulations. A certified water treatment plant operator should operate the plant. The potable water should be free of taste and odor and meet required water quality standards.

11.3.6 Wastewater Treatment Plants. Centers shall comply with all requirements of their National Pollutant Discharge Elimination System (NPDES) permits, as imposed by the EPA (or as imposed by the state or local government). Properly qualified personnel with required state certification shall operate the wastewater treatment facilities. All certifications shall always be maintained current and valid.

11.3.6.1 General Waste Water Treatment Operations. Wastewater treatment facility operations should provide continuous, cost effective, and efficient treatment of all wastewater delivered to the facility. Such operations include general operation of plant equipment, valves and piping, sampling and lab analyses, waste and effluent disposal, and other related services. Treatment facility conditions shall meet applicable health and safety standards and be maintained clean and orderly at all times. Operations shall be accomplished with proper regard to equipment and components to ensure operating efficiency and longevity of service life.

11.3.6.2 Waste Disposal. Waste shall be disposed of at a frequency sufficient to maintain clean and orderly collection sites with no overflow of waste material. Wastes (including sludge, grit, screenings, and other waste solids) shall be routinely collected and transported to a properly classified disposal site. Wastes deemed hazardous shall be transported and disposed of in accordance with Department of Transportation (DOT) and EPA requirements. All waste disposal practices shall be accomplished in accordance with all applicable environmental regulations. All records, receipts, manifests, and log entries shall be maintained in accordance with NPDES permit and state and local requirements.

11.3.6.3 Sampling and Laboratory Analysis. Sampling and laboratory analytical services shall be provided to support regulatory agency operating requirements. Such sampling and testing procedures shall be accomplished in

accordance with applicable operating permit conditions. A complete set of laboratory records shall be kept for all laboratory tests, including: date and time of sampling, type of sample, name of sample, sampling location, test performed, and test results. In addition, results of such laboratory analyses shall be assembled into reports to conform to the procedures and requirements of the NPDES permit (or other state and local permits, if applicable) and submitted to the EPA (or state and local agency). Copies of all testing records and associated correspondence shall be maintained on file by the NASA organization responsible for operatng the system and related equipment. These records shall be part of the CMMS records.

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